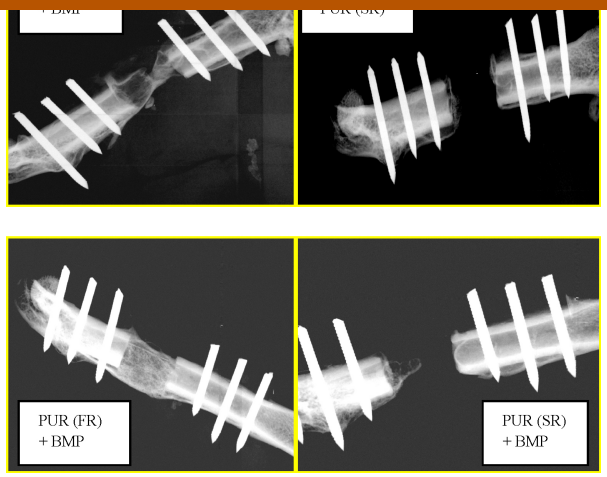

Fig. 1. Radiographs to illustrate bone regenerated in a CSD. Collagen = collagen carrier, PUR = polyurethane scaffold, SR = slow release, FR = fast release, BMP = recombinant human Bone Morphogenetic Protein-2.

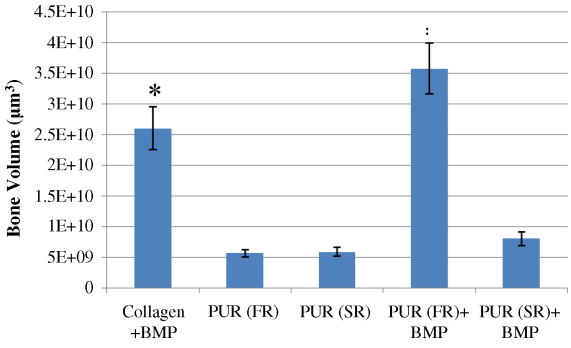

Fig. 2. Graph illustrating the Bone Volume regenerated in a CSD.

Figs. 1 and 2. *Study 2*: There were no significant differences between the groups in the bacterial load in bone (as per CFUs/mg bone) – see Fig. 3.

Discussion: PUR scaffolds are capable of effectively regenerating bone and reducing infection. The PUR (FR) scaffolds with BMP regenerated more bone than the current standard of care (BMP on a collagen sponge). This bioabsorbable and osteoconductive scaffold reduced bacteria as well as bone cement, the advantage of not needing for osteogenic factors and antibiotics to promote bone regeneration and prevent infection. This approach may reduce complications because it protects the implant from colonization and reduces the bioburden.

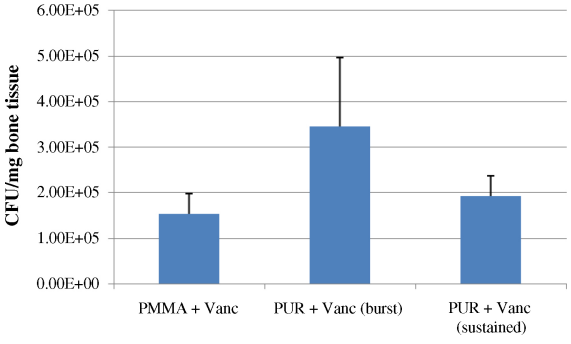

Fig. 3. Graph illustrating the CFUs/mg bone tissue. PMMA = polymethylmethacrylate (Palacos) beads, Vanc = vancomycin, PUR = polyurethane scaffold, burst = burst release, sustained = sustained release.

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1A.17

Risk factors for infections in combat-related open fractures

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Background: Extremity injuries on the battlefield are commonly due to high energy mechanisms. These cause significant injury to soft tissue and bone, are usually heavily contaminated, and can be associated with a delay in initiating treatment. As a result infection rates of up to 50% have been reported. The aim of this study was to determine the risk factors associated with infection following combat-related open fractures

Methods: Using the prospectively maintained JTTR, this is a cohort study of British military casualties in Iraq and Afghanistan between August 2003 and May 2008. All patients with severe open fractures that did not undergo field amputation were evaluated for demographic data, management strategies at the time of injury through evacuation, and infectious complications.

Results: There were 84 patients with 85 extremities totaling 20 infected extremities (17 lower extremity and 3 upper extremity) and 65 uninfected extremities (42 lower extremity and 23 upper extremity). Those with uninfected extremities had more Gustilo Classification IIIa injuries (60% versus 20%, $p = 0.002$) while infected extremities had more IIIb (75% versus 34%, $p = 0.001$). Explosion related injuries occurred in 68% of uninfected extremities versus 45% in infected extremities ($p = 0.07$). Those that received a tourniquet in the field were associated with more infections ($p < 0.001$). There was also a difference in year of injury with more infections occurring in those injured in 2008. There was no difference in injury severity score, age, timing of evacuation from injury, timing of surgery from injury, time to arrival in England, use of QuikClot®, use of HamCon® dressing, use of external fixation or plaster use. Penicillin and flucloxacillin were used more commonly used in those uninfected ($p = 0.008$) while those that became infected had the addition of anaerobic coverage (0.06). There were 5 cases that developed osteomyelitis (all tibia) while 15 developed deep wound infections. The most commonly recovered bacteria were *Bacillus* species, *Acinetobacter* species, *Staphylococcus aureus* and *Pseudomonas aeruginosa*. *S. aureus* were recovered later in patients' clinical course in contrast to *Acinetobacter*, which were recovered earlier. On multivariate analysis, Gustilo classification, tourniquet in the field, and the presence of *P. aeruginosa* or *S. aureus* were associated with infection.

Conclusions: Infections occurred in 24% of those with mangled extremities to include 5 (6%) cases of osteomyelitis. Those with severe injuries as indicated by Gustilo classification or tourniquet use in the field were associated with infections. In addition, the presence of certain bacteria such as *P. aeruginosa* and *S. aureus* were associated with infectious complications, while *Acinetobacter* was not. It is unclear what impact a penicillin-based regimen had on

infection versus additional anaerobic coverage. Continued focus is required to mitigate the infectious complications of combat-related mangled extremities.

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1A.18

Evaluation of the west riding trauma skills course

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Introduction: The AO Foundation Operative Fracture Management course is the gold standard in training courses currently available for trainees at ST3 level. However it is expensive (approximately £1050) and over subscribed. The West Riding Trauma Skills Workshop is a practical workshop teaching operative skills and basic principles of fracture management expected of an ST3 trainee, at a reduced cost. Candidates' feedback was used to improve the course and this was further analysed after the second year of running to determine whether the teaching objectives were achieved.

Methods: This intensive course was held over a weekend, further details: www.orthotrainee.com. Trainees were given short instructional lectures by consultant orthopaedic surgeons followed by workshops, with a maximum ratio of 4 candidates per consultant. The majority of time was allocated to workshops (total 5 h) and 3 h 30 min in lectures. The trauma inventory including implants and saw bones were provided by Stryker Trauma UK, ensuring a nominal candidate fee (£50). Candidates' feedback was anonymously collected and analysed using non-parametric methods appropriate for ranked data.

Results: Twenty-one of 22 (95%) candidates completed feedback questionnaires in 2008, 18 out of 18 (100%) candidates completed feedback in 2009 (Table 1).

Overall feedback was very positive with high scores for all the sessions, both years. An informal session on theatre tips and tricks was present in the 2008 course but due to low ratings was not repeated in the 2009 course to allow more practical time. According to Wilcoxon matched pairs analysis there was only one session which had a significant difference between the 2 years, the intramedullary nailing lecture ($p = 0.0445$), due to improved scores.

Table 1
Breakdown of feedback scores (1 = minimum, 5 = maximum approval).

Session	Type I = informal session L = lecture W = workshop	Median score 2008	IQR (2008 scores)	Median score 2009	IQR (2009 scores)
Bone healing	L	4	3–4	4	4–5
Fixation	L	5	4–5	4	4–5
Screws	L	4	4–5	4	4–5
Plating	L	4	4–5	4	4–5
small fragment	W	5	4–5	5	4–5
intramedullary nailing	L	4	3.5–5	5	4–5
Proximal femoral nail	W	5	4–5	4.5	4–5
IM nailing	W	5	4–5	5	4–5
Hip # treatment	L	4	4–5	5	4–5
DHS	W	5	4–5	5	4–5
Damage control orthopaedics	L	5	4–5	5	4–5
External-fixator	W	5	4–5	5	4–5
Theatre tips and tricks	I	3	3–4	–	–

Conclusions: Due to an alteration in the training structure of junior doctors, orthopaedic trainees have reduced exposure in theatre and this may impact on the frequency of opportunities for trauma operating. Candidates gave very high ratings for the course, demonstrating it is possible to teach practical skills course at a low cost. This course is designed to provide further opportunities, in addition to those provided on the AO course, in terms of improving practical skills and knowledge of fracture management. This may improve the likelihood of a trainee being able to use these trauma operating skills in a time pressured environment.

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1A.19

Tibio-fibula transposition in high energy closed fractures

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Introduction: We report two cases of failed attempts at closed reduction of high energy tibial fractures with associated fibula fracture. Operative reduction revealed that the proximal fibula fragment was entrapped in the medulla of the distal tibial fragment. This is an uncommon occurrence and has not previously been reported.

Material and methods: Two cases presenting to a district general hospital over a 4-month period. The first case was a 39 year old involved in high speed motorbike collision. The second case was a 14 year old following a fall of 3 m. The injuries were closed and the mechanism of injury consisted of a high energy valgus forces applied to the leg on impact. On scene emergency medical services reported a 90° valgus deformity of the injured limbs. In both cases the limbs were realigned on scene and stabilized with a box splint.

Results: Adequate alignment of the tibia could not be achieved by manipulation under sedation or manipulation under anaesthesia. Operative reduction was undertaken and exposure of the fracture sites revealed that the proximal fibula fragment was entrapped in the medulla of the distal tibial fragment. Reduction required traction and simulation of the mechanism of injury i.e. valgus force to release the trapped fibula fragment.

Conclusion: In closed high energy tibial fractures, with an associated fibula fracture, it is possible for the fibula to be transposed into the tibia. Transposition occurs during the initial first aid attempt to realign the deformed limb. Our experience demonstrates that closed reduction is not always achievable in these circumstances even under anaesthesia.

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1A.20

The outcome of grade III open tibial fractures treated at a District General Hospital at 5 years

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Recent combined guidelines from the British Orthopaedic Association and British Association of Plastic Reconstructive and Aesthetic Surgeons about the management of severe open limb fractures recommends the treatment of these cases in specialised centres with appropriately trained orthopaedic and plastic surgeons. Thirty-three grade III open tibial fractures have been treated at the Rowley Bristow Orthopaedic Unit since 2004 and were